Knowledge Commoning: Scaffolding and Technoficing to Overcome Challenges of Knowledge Curation

Abstract

Extant approaches to information provisioning to farmers to improve agricultural productivity, and thereby alleviate poverty have relied on top-down external expert-driven knowledge. Such external knowledge involves decontextualised content and the use of technical language, and is resource-intensive. An alternative view emphasises the need to explore indigenous knowledge exists in rural communities, which, in contrast, requires the use of local resources, is easily understandable, and has greater potential for adoption. This paper explores how information and communication technologies, specifically videos, can be leveraged to curate such indigenous knowledge and convert it to *knowledge commons*. Adopting a case study approach that involved multiple sources of data collection over a nine-year period, we unearthed a dynamic process model that we labelled as *knowledge commoning*. It is a process through which latent-action-oriented knowledge from high-yield farmers embedded within its social context is made available as commons. The creation of knowledge commons is an iterative process between knowledge curation and knowledge dissemination, and is guided by the demand and uptake potential within local farming communities. Further, we describe how socio-cultural barriers in knowledge commoning can be overcome through *scaffolding*, involving the concealment of social transformation objectives within another goal desired by the community. Technological challenges can be overcome through the process of *technoficing*, which encompasses pursuing social objectives using technology that is appropriate for the purpose. Building on our process model, we offer contributions to theory, practice, and policy.

Keywords: knowledge commons, rural India, knowing-in-practice, indigenous knowledge, sustainable development, poverty alleviation

1. Introduction

Approximately 3.4 billion people live in rural areas, among which 92% are in developing countries (OECD, 2016).[1] Over half of the population in developing countries live in rural areas and rely on agriculture for livelihood and employment (Trendov et al., 2019). In India, agriculture accounts for 23% of the gross domestic product, employs 59% of the country's total workforce and provides livelihood to 70% of rural households.[2] Considering that 79% of the rural population lives on under US$1 a day (World Bank, 2018), improving agriculture productivity is an important means of reducing poverty (de Luca et al., 2012). Despite huge government investments, agricultural productivity in rural areas of developing countries still lags far behind that in developed countries (Aker et al., 2016; FAO, 2019b). The lack of timely information about cost-effective agriculture practices is a primary reason for the low agriculture productivity in rural areas (Aker et al., 2016; Sutter et al., 2022). Further, since most farmers in the rural areas of developing countries are smallholder farmers with limited resources, they lack access to relevant knowledge and, consequently, often use suboptimal agricultural practices (Qureshi et al., 2018b).

Governments and international organisations have attempted to provide the information needed in rural communities through agriculture extension programs that engage trained field officers to deliver information inputs (Anderson & Feder, 2004). However, these programs have had low outreach and poor impact (Feder et al., 2004) because they are based on expert knowledge and do not leverage the context-specific knowledge and experience of local farmers. In response, information and communication technologies (ICTs) have been proposed to enhance farmers' access to and sharing of agriculture knowledge and information (FAO, 2019a,b; Oduor et al., 2018). The use of ICT accelerates the productivity of the agriculture sector and benefits farmers (FAO & ITU, 2022). In addition, the literature suggests that the use of ICTs can help connect and reach more farmers at a lower cost (Aker et al., 2016), provide reliable and efficient access to information (FAO & ITU, 2022),

[1] Based on the definition of the United Nations (2021), developing countries are countries that have not achieved significant industrialisation. They are also characterised by a lower Human Development Index (O'Sullivan & Sheffrin, 2003).
[2] See http://www.fao.org/india/fao-in-india/india-at-a-glance/en/.

increase farming productivity (Lio & Liu, 2006) and provide farmers with better market access (FAO, 2019b).

Research on ICT for Development (ICT4D) has focused on how ICT can be made accessible to rural farmers (Wyche et al., 2016) and how ICT affects agricultural productivity and economic gains (Jha et al., 2016; Oduor et al., 2018). However, in the literature, ICT is primarily viewed as a channel to disseminate agricultural practices developed centrally by agricultural scientists, with attention focused on technical details (Birner & Anderson, 2007; Gandhi et al., 2007). Such expert-produced knowledge has limited utility in rural contexts due to its resource intensiveness (Gandhi et al., 2007), technical language (Oduor et al., 2018) and decontextualised content (Anderson & Feder, 2004; Birner & Anderson, 2007). In contrast, indigenous knowledge that leverages local resources can be easily understood by local farmers and has high potential for adoption by farmers (Dweba & Mearns, 2011; Puri, 2007; Qureshi et al., 2018b; Sutter et al., 2022). Thus, there have been calls to curate the knowledge of rural communities (Bruton et al., 2021; Dweba & Mearns, 2011) by partnering with rural farmers and developing more context-specific solutions to agricultural problems (Bhatt et al., 2022).[3]

However, the processes and challenges of curating agriculture knowledge in rural and resource-constrained contexts remain understudied. A more comprehensive understanding of agriculture knowledge curation in rural areas is important because it holds the key to addressing the grand challenges of poverty, hunger, economic inequality and gender inequality (Qureshi et al., 2021b).[4] Further, although there is a substantial body of literature on knowledge management, it has largely been developed in the context of formal organisations, where knowledge is highly concentrated in specialised activities, and the expertise of individuals is known through recruitment and training processes (Prieto Pastor et al., 2010; Qureshi et al., 2018a). However, locally relevant knowledge in the rural context is hidden and spread across sparsely populated areas (Gupta, 2016; Sutter et al., 2022). Thus, an

[3] Knowledge curation is a careful accumulation and stewardship of local and indigenous knowledge based on predefined criteria with the intention of making it available to others who might benefit from such knowledge.

[4] The Sustainable Development Goals (SDGs) are a set of 17 intertwined global goals introduced by the United Nations in 2015. The goals are intended to be achieve by 2030. The relevant SDGS here are SDG1 (no poverty), SDG2 (zero hunger), SDG5 (gender equality) and SDG10 (reduced inequality).

in-depth exploration of knowledge curation processes in rural areas will complement the literature on knowledge management in general.

Our 35-year combined experience in the field suggests that, in most cases, farmers in rural areas are not aware of the uniqueness and value of their agricultural practices. Many farmers have knowledge about growing traditional crops that they (at times mistakenly) believe is not useful. Further, they may no longer use some knowledge due to changing environmental conditions and may think this knowledge is a misfit. However, this knowledge can be of great value to other farmers. Thus, we refer to this knowledge as latent.[5] Further, unlike the organisational context, the rural context is resource constrained (Bhatt, 2022; Bhatt et al., 2019, 2022; Hota et al., 2019; Qureshi et al., 2021b), which results in a lack of resource deployment for knowledge curation. While the organisational context is designed for and characterised by the mandated use of information systems (Brown et al., 2002; Hossain & Quaddus, 2015)[6] and mandatory knowledge contribution (Gagné, 2009; Minbaeva, 2013), the rural context is characterised by voluntariness that likely results in different drivers for knowledge contributions.

Another critical difference is that most employees of the organisations are articulate and trained in knowledge management (Minbaeva, 2013; Prieto Pastor et al., 2010) and can participate in the knowledge curation, whereas rural farmers have no formal education. Many of them are illiterate and lack skills in articulating what they know, thus presenting difficulties in the process of knowledge curation. Given their formal education, induction training and organisational socialisation, employees in organisations develop shared mental models that facilitate knowledge curation and dissemination (cf. Ghobadi & Mathiassen, 2016). However, due to differences in cultures, customs, languages, dialects, and soil and climatic conditions, farmers in one rural region may not share mental models with farmers in other regions.

Finally, although discrimination and prejudices are present in the organisational context (Bhardwaj et al., 2021; Maurer & Qureshi, 2021b), they are often covert

[5] 'Latent knowledge' refers to knowledge that is either unrecognised in its value and uniqueness or assumed to be not useful due to its focus on traditional crops or misfit due to changed environmental conditions. We do not intend to communicate the meaning sometimes associated with the word 'latent'—invisible or unobservable. The practices known to these farmers can be observed through their work.

[6] We acknowledge that employees in organisations may find ways to overcome or bypass the use of mandated information systems (Ferneley & Sobreperez, 2006) and by extension mandated knowledge contribution systems.

rather than overt (Kang et al., 2016; Kantola, 2008). However, in the rural context, social structural barriers, such as caste-based or gender-based discrimination, are prevalent (Bhatt et al., 2022; Riaz & Qureshi, 2017; Vikas et al., 2015) and actively prevent farmers in marginalised social groups from taking part in knowledge sharing (Qureshi et al., 2018b; Sutter et al., 2022).

Thus, it is important to understand how the latent knowledge dispersed within a local agriculture community is curated and made accessible to a larger community as *knowledge commons* in the rural contexts that are characterised by resource constraints and social hierarchies. The term 'knowledge commons' refers to the application of the commons approach to the preservation, creation, use and management of knowledge (Frischmann et al., 2014; Hess & Ostrom, 2007). The knowledge commons leverages local knowledge and belongs to local communities (Frischmann et al., 2014; Hess & Ostrom, 2007), although in some instances, it might be curated by a social intermediary (i.e., a socially-oriented organisation) (Bollier & Henfrich, 2014). Many farmers can benefit from the creation of such knowledge commons (Dolinska & d'Aquino, 2016) as they can have free access to local agriculture knowledge, resulting in enhanced productivity. However, the processes that lead to knowledge commons are not yet understood. Thus, in this research, we explore:

1. How latent knowledge dispersed within rural agriculture communities is converted into knowledge commons?
2. How to overcome the challenges encountered in knowledge commons creation?

To explore our research questions, we conducted a qualitative case study of *FarmScreen*, a social intermediary that worked with local partners to identify latent knowledge, encode the local agricultural practices, and organise them in video format to create knowledge commons that other farmers were able to access through communal screenings. Our data collection involved nine years of field work, including 747 semi-structured individual interviews, 151 interviews in group settings, 191 unstructured interviews with local farmers and hundreds of pages of organisation reports and archival materials.

We develop a process model comprising knowledge realisation, knowledge solicitation, knowledge encoding, knowledge examination and knowledge organisation. This process model helps in identifying latent knowledge and building a

repository of knowledge. We also identify a dynamic process—encompassing knowledge curation and dissemination and their interrelationships—that helps convert latent knowledge to knowledge commons. We label this process *knowledge commoning*, a process through which latent knowledge of agricultural practices from high-yield farmers embedded in their social context is made available as commons. Knowledge commoning involves five interacting stages: knowledge realisation, knowledge solicitation, knowledge encoding, knowledge examination and knowledge organisation. Knowledge commoning is facilitated through *scaffolding* to overcome social barriers and through *technoficing* to overcome technological resource barriers. Scaffolding describes processes that enable transformation in patterns of inequality in a community wherein the goal of reducing inequalities is concealed within another goal of the community, like how a scaffold masks the building inside (Mair et al., 2016; Sutter et al., 2017). For instance, a water and sanitation program can be used as a pivot to transform caste differences in rural communities in India (Bhatt et al., 2022; Sutter et al., 2022). In our case, we discuss how empowering marginalised communities in the knowledge commoning process is masked through communicated benefits of diversifying sources of knowledge. Technoficing is 'the purposeful pursuit of social objectives using a technology that is good enough and appropriate' for the task or activity it is being deployed for (Qureshi et al., 2021b, p. 654). For instance, Hota et al. (2019) delineated how social enterprises leverage simple mobile-based technologies that are handled by village-level entrepreneurs to provide agricultural information and banking services and thereby solve productivity issues. We show how low-cost video recorders, projectors and walls as make-shift screens are good enough and appropriate for meeting knowledge commoning requirements within the prevailing resource constraints.

Our research makes several contributions to the ICT4D and knowledge management literature. First, we provide a nuanced explanation of the processes involved in commoning dispersed latent knowledge in rural communities using video as a tool. Second, our study highlights the difficulties posed by cultural barriers and social hierarchies manifested in gender and caste discrimination through scaffolding during knowledge commoning. Third, our study illuminates the significant role of technoficing in knowledge commoning to address issues related to lack of resources, poor infrastructure and illiteracy. Finally, our study calls attention to the limitations of using top-down, formal expert-led knowledge for increasing agricultural productivity

in rural areas and argues for capturing locally relevant knowledge available within rural farming communities.

Our study proceeds as follows. In Section 2, we review the literature on practice-based perspectives on knowledge commoning and ICT4D. In Section 3, we describe the case study approach we used to explore our research questions and provide details on data collection and data analysis. In Section 4, we develop a knowledge commoning model. In Section 5, we discuss the contributions of this research and provide suggestions for future research and policy. In Section 6, we conclude our study.

2. Theoretical foundation

Knowledge is a 'fluid mix of framed experience, values, contextual information and expert insight that provide[s] a framework for evaluating and incorporating new experiences and information' (Davenport & Prusak, 1997, p. 5). Knowledge commons is a repository of knowledge, generally on a particular topic, that is contributed by and available to all the community members (Bollier & Helfrich, 2014; Frischmann et al., 2014; Hess & Ostrom, 2007). Knowledge commons is created through knowledge contribution from community members. We draw on the development in the knowledge commons and ICT4D literature while borrowing the theoretical view of *knowing in practice* (Orlikowski, 2002) to understand how knowledge commons can benefit farmers in rural areas.

2.1. Knowledge commons

The emerging phenomenon of knowledge commons is an outgrowth of research on natural resources commons (Hess & Ostrom, 2007; Ostrom, 2009). The knowledge commons literature draws upon Ostrom's institutional analysis and development perspective that builds on natural resources commons (Ostram et al., 1994). However, knowledge commons is distinct from natural resource commons. This is because knowledge is non-subtractive and non-rivalrous in nature, and knowledge commons is associated with concerns related to underuse rather than overuse (Hess & Ostrom, 2007; Frischmann et al., 2014). The non-rivalrous nature and the concerns associated with the underuse of knowledge highlight the need for organisations responsible for curation and governance to promote inclusive use, diverse knowledge contributions and fair distribution of knowledge among geographically dispersed actors—in our case, farmers.

The literature on knowledge commons in the community context views agricultural knowledge as locally embedded and often traditionally acquired by farmers through intergenerational transfer (Galang & Vaughter, 2020). However, the literature also acknowledges that farmers acquire knowledge through trial and experimentation (Dolinska & d'Aquino, 2016). Farmers manage and apply knowledge creatively with limited locally available resources to achieve sustainable agriculture (Altieri & Nicholls, 2017). These local practices have the potential to mitigate the effects of climate change on agriculture productivity, and wider adoption of local knowledge can help with adaptation to the environmental effects of climate change (Altieri & Nicholls, 2017; cf. Parth et al., 2021).

'Local knowledge' refers to the cumulative, evolving body of practices, activities and understandings about the relationships between farmers and their farming ecosystems (Berkes et al., 2010). Local knowledge is manifested through practices and social embeddedness related to farming ecosystem management (Galluzzi et al., 2010), knowledge about landraces (Bellon & Hellin, 2011; Negri, 2003) and management of resources used in farming, such as manure, water and biopesticides (Perreault, 2008). In many cases, local knowledge is transferred intergenerationally (Reyes-García et al., 2018). At times, such knowledge evolves in response to changing local environments and cultural contexts (Reyes-García et al., 2018; Parth et al., 2021), which creates diversity in the local knowledge system. Emerging research suggests that historically in many communities, local knowledge has been treated as knowledge commons and is freely shareable within communities (Bollier & Helfrich, 2014; Hess & Ostrom, 2007). However, local indigenous knowledge becomes fragmented and inaccessible over time due to the introduction of expert-led external knowledge and substantial migration from rural to urban areas (cf. Šūmane et al., 2018). In places that suffer from social inequalities, such as rural India's caste and gender divide (Bhatt, 2022; Bhatt et al., 2022; Riaz & Qureshi, 2017; Sutter et al., 2022), local knowledge has become further fragmented and inaccessible. Such divides create internal boundaries within communities, creating segments of people among whom knowledge does not permeate freely or is even actively blocked (Qureshi et al., 2018b).

2.2. A practice-based perspective on knowledge management

Research on knowledge management is built on the classic Polanyi (1967) taxonomy that categorises knowledge as either tacit or explicit. Tacit knowledge tends to be highly personal and difficult to express, whereas explicit knowledge can be readily accessed and sorted (Grover & Davenport, 2001). A taxonomy-based perspective generally treats knowledge as 'an independent, factual object' (Ibert, 2007, p. 104) and a 'set of discrete elements' (Orlikowski, 2002, p. 250). This taxonomy-based perspective has guided scholars to examine various strategies, routines and techniques through which knowledge is generated, codified and transferred (Grover & Davenport, 2001). However, a pure taxonomic perspective overlooks some crucial aspects of knowledge: that 'tacit and explicit knowledge are mutually constituted … [and] inseparable' (Tsoukas, 1996, p. 14) and that knowledge 'conveys a performative conception and treats human expertise as being inseparably intertwined with social practices' (Ibert, 2007, p. 104). Thus, scholars have been trying to conceptualise knowledge in a more 'inherently indeterminate' manner (Brown & Duguid, 1991; Orlikowski, 2002).

The concept of *practice* is an alternative lens to understand the dynamics of knowledge (Feldman & Orlikowski, 2011; Levina & Vaast, 2005; Monteiro et al., 2012). Practice is a 'recurrent, materially bounded and situated action engaged in by members of a community' (Orlikowski, 2002, p. 256). Central to a practice-based perspective is 'the notion that social life is an ongoing production and thus emerges through people's recurrent actions' (Feldman & Orlikowski, 2011, p. 1240). Regarding knowledge management, a practice-based perspective emphasises knowledge as 'a dynamic and ongoing social accomplishment. … It leads us to focus on knowledge, not as static or given, but as a capability produced and reproduced in recurrent social practices' (Orlikowski, 2006, p. 460). Thus, departing from the taxonomy-based perspective, a practice-based perspective of knowledge focuses on the capability to put knowledge into practice (Orlikowski, 2002). As such, knowledge management is embedded in practices that allow knowledge to be disseminated among communities with similar practices (Brown & Duguid, 1991).

Knowledge management is important for livelihood enhancement in rural areas (Cannarella & Piccioni, 2011; Urquhart et al., 2008). Specifically, recognition of the accomplishment of knowledge management has led to various proposals for poverty alleviation and societal transformation, such as facilitating symbolic actions (Slavova

& Metiu, 2021), introducing boundary objects (Qureshi et al., 2018b) and developing knowledge alliances (Puri, 2007). The practice-based perceptive offers a strong foundation to study knowledge curation in a rural agricultural context where knowledge is situationally constituted by a person (e.g., farmers) acting in a particular setting (e.g., natural conditions) and engaging aspects of the self, the body and the physical and social world (e.g., beliefs and norms) (Monteiro & Parmiggiani, 2019). However, despite the promising theoretical implications, a comprehensive understanding of the practice-based knowledge curation process in rural areas remains scant. Unlike an organisational context where technology, training and rewards create positive incentives for everyday practices of knowledge curation within and across communities (Argote & Miron-Spektor, 2011; Østerlie et al., 2012), knowledge sources (e.g., experienced farmers) in rural areas are often isolated and deeply rooted in culturally conflicted traditions and, in turn, inhibit knowledge curation practices (Cannarella & Piccioni, 2011).

Among the factors facilitating practice-based knowledge curation in rural areas, the literature has tended to emphasise the role of boundary objects. Boundary objects are artifacts that are flexible enough to accommodate 'local needs' from different communities at the same time and robust enough to maintain a common identity (Carlile, 2002; Qureshi et al., 2018b). Boundary objects enable knowledge curation practices by allowing diverse sources of knowledge to 'negotiate collective meaning through and around those objects' (Barrett & Oborn, 2010, p. 1204). A typical boundary object is an information technology-based knowledge management system (Levina & Vaast, 2005). For example, video footage can be used as a boundary object to curate knowledge about agricultural activities among farming communities with different social backgrounds (Qureshi et al., 2018b). More specifically, video footage is flexible enough to allow farmers with different backgrounds to gain awareness of the situated agricultural skills in a common ground yet also stable enough for knowledge curation and dissemination. However, it has been argued that boundary objects, if not correctly structured and stewarded, may reify cultural differences and inhibit knowledge curation (Barrett & Oborn, 2010), especially considering the entrenched social structures and cultural complexities in rural areas (Qureshi et al., 2018b; Slavova & Metiu, 2021). Thus, it is important to explore practice-based knowledge curation in a rural context.

2.3. ICT4D and knowledge curation in a rural agricultural context

ICT4D has a rich legacy as a diversified field in the IS literature, exploring the relationships between ICT implementation and development (Avgerou, 2008). The ICT4D literature emphasises the role of digital technologies in addressing various societal challenges (Nijhia & Merali, 2013). Digital technologies have the potential to bring economic development by enhancing access to information and knowledge (Aker et al., 2016; Hayes & Westrup, 2012). Further, they can lead to societal changes by transforming the nature of social relations (Faik et al., 2020; Qureshi et al., 2018a). Scholars have increasingly shown interest in understanding how ICT4D can address persistent social hierarchies and enhance social inclusion (Chipidza & Leidner, 2019; Faik et al., 2020). The literature suggests that digital technologies can facilitate social inclusion by mitigating the concerns of the digital divide (Fox & Connolly, 2018).

The ICT4D literature generally acknowledges that ICT can empower the poor in rural areas by providing reliable and timely access to knowledge (Puri, 2007; Urquhart et al., 2008). For example, ICT implementation benefits rural people by transforming fragmented raw data into structured information (Kelly, 2018), mitigating information asymmetries between rural and urban entities (Parthiban et al., 2020, 2021) and capturing and sharing information in local communities (Qureshi et al., 2018b). However, past efforts have primarily used ICT in a fragmented manner and as a top-down, urban-based initiative to achieve development goals in rural areas (Jha et al., 2016). Consequently, many ICT investments have proven to have limited or unsustainable effects on rural development (Chipidza & Leidner, 2019).

The absence of contextualisation (DeRose, 1992) has been recognised as a critical reason for ICT's mixed effects on rural development (Avgerou, 2008). Hayes and Westrup (2012, pp. 26–27) suggested three dimensions to contextualise ICT4D: (1) to 'attend to the ways in which context is bound up with knowledge claims as to what counts as significant and what is not'; (2) to 'examine the ways in which context is inextricably interlinked with issues of power and who gets to speak to whom'; and (3) to 'consider the metaphor of intersecting networks in which concepts, materials, and people circulate'. To illustrate the importance of contextualism in knowledge curation, consider that (1) a farmer in a remote rural village may understand seeding in a different way than a professor from urban experimental farms because experimental farms' findings may not directly apply to the farmer's specific

conditions; (2) the farmer may prefer learning seeding from an experienced peer than a professor because the peer is more approachable; and (3) the farmer may be in favour of sharing and learning from specific people because they share a common social network or a close social relationship.

To contextualise ICT-enabled knowledge curation in the rural agriculture sector, we broadly define a rural area, being opposite to an urban area, as a place that has a small population and low population density with most of the population engaged in agricultural activities (Dijkstra et al., 2020). Nijhia and Merali (2013) emphasised the power of social and cultural dimensions in affecting ICT implementation outcomes in rural areas. Walsham (2017) observed that social and cultural structures are unique contextual characteristics of the implementation of ICT4D projects. According to Walsham (2017, pp. 20–21),

> cultural barriers to [ICT] implementation represent more difficult problems than technological issues because they provide the social context within which IS are interpreted and given meaning. … computer-based IS should be conceptualized as social system in which technology is only one of the dimensions.

The literature has highlighted two social characteristics to contextualise the rural agricultural sector. First, social hierarchies exacerbate disparities within local agricultural communities (i.e., between social groups with a geographic community). A rigid social hierarchy (e.g., the caste system in India) is deeply rooted in rural people's lifestyles, beliefs and attitudes, which propagates a separation among local rural communities and a separation between rural and urban communities (Duncan, 1996). To investigate social hierarchies in rural India, Thorat (2009) conducted a field study of 550 villages across 11 states. He found that people from the lowest caste (i.e., the Dalit) were not allowed to trade agricultural products to cooperatives and private buyers due to restrictions imposed by authorities from higher castes. In this instance, communities in the lower social hierarchies have inferior resource endowments to access advanced agriculture knowledge (Qureshi et al., 2018b; Sutter et al., 2022). Second, marginalisation aggravates inequality. Farmers in rural areas rely on their agricultural experience accumulated over several generations in the local natural conditions (Norgaard, 1984). These farmers are primarily organised as smallholder communities that only trust people within the same social network (Bhatt et al., 2022; Qureshi et al., 2016; Qureshi et al., 2018b). Knowledge fragmentation emerges as people from different social networks have no incentives

for knowledge sharing. Further, although women produce over 50% of the world's food and comprise approximately 43% of the agricultural labour force (Croppenstedt et al., 2013), they have either no or minimal part in the decision-making process regarding agricultural development (Bhatt et al., 2022; Sutter et al., 2022). In sum, the rural context tends to disadvantage people in lower social hierarchies and marginalised social groups.

To be as conceptually robust as possible, we conducted a literature review. Specifically, we performed a search of empirical articles published in highly regarded information systems outlets from 2000 to 2020.[7] We extracted 10 articles that have explicitly defined or described knowledge from a practice-based perceptive. As Table 1 shows, although these articles provide substantial details about knowing-in-practice in a knowledge-intensive organisational environment, such understanding is still in a nascent stage in the rural setting. The effectiveness of ICT4D implementation in knowledge curation has been questioned due to the reliance on urban-based design and a lack of understanding of the rural context (Chipidza & Leidner, 2019; Hayes & Westrup, 2012; Walsham, 2017). Considering the social characteristics as a premise underpinning knowledge curation in a rural agricultural context offers a promising direction to enrich both the ICT4D and knowing-in-practice streams of literature. In the empirical case study below, we explore the central role of practices that produce and sustain knowledge curation enabled by videos as a basic but valuable vehicle that recognises the unique rural context.

Table 1. Detailed studies of knowing in practice

Source	Level of analysis	Type of system	Description	Dimensions	Effect
Bassellier et al. (2003)	Individual	General systems, such as email, LAN and WWW	'Knowing refers to the ability to put knowledge into practice, […] as belonging to an epistemology of practice' (p. 319).	Not explicitly explained but related to dynamic process and part of an action	Articulating a compelling vision about the positive effects of information technology (i.e., championing information technology)
Levina & Vaast (2005)	Individual	Intranet-based FAQ, firm website and emails	'Knowing as an ongoing social accomplishment, constituted and reconstituted in	Boundary spanning and boundary objects	Forming a joint field where knowledge transforms between different business units

[7] We searched the keyword 'knowing in practice' in the eight senior scholar basket journals and three contenders (Fitzgerald et al., 2019).

			everyday practice' (p. 337).		
Patnayakuni et al. (2006)	Firm	Computer-aided software engineering tools	Knowledge is about simultaneously knowing and acting; it is an 'ongoing social accomplishment, constituted and reconstituted as actors engage the world in practice' (p. 548).	Collaborative exchange and explicit knowledge integration	Integrating knowledge throughout the process determines system development performance
Puri (2007)	Individual	Geographic information systems	[Knowing is made up by] 'groups of people in specialised organisations with expertise in particular fields' (p. 357).	Context and practice	Forming alliances that both martial characteristics and indigenous knowledge
Van den Hooff and Huysman (2009)	Firm	ICT infrastructure (ICTI)	'Knowledge sharing is stimulated […] by rich social interaction and its immersion in practice' (p. 1).	Emergent and engineering	Knowledge sharing is determined by social capital (partially influenced by ICTI)
Østerlie et al. (2012)	Firm	Sensors and data visualisation applications	'Knowing is constituted through everyday work, through human actions and through practices' (p. 86).	Instrumentation, interpretation and learning	Knowing emerges from material phenomena, material arrangements and practices
Pozzebon and Pinsonneault (2012)	Firm	Enterprise resource planning system (projects)	[Knowing is] 'something that is relational in nature, evolves and is generated in actions' (p. 38).	Not explicitly explained but related to socio-materiality	Influencing the negotiating trajectories of client-consultant relationships
Shollo and Galliers (2016)	Firm	Business intelligence systems	'Knowing is seen as the working knowledge practices that socially construct our world' (p. 345).	Negotiation, articulation, contestations and data selection	Transforming data into organisational knowledge and then being utilised in acting
Monteiro and Parmiggiani (2019)	Firm	Internet of Things (IoT)	'Knowing is material, but significant divergence regarding how, be it entangled, imbricated, inscribed, or performative' (p. 169).	Not explicitly explained but related to the liquefied and open-ended characteristics of a system	Knowing becomes algorithmic, streaming injected, scoped and politically charged

3. Method

To explore how ICT implementation enables knowledge curation in a rural context, we conducted a longitudinal case study (Eisenhardt, 1989) over eight years and nine months (2009–2017)[8] in rural Madhya Pradesh, a province situated in central India. Given that the study aimed to explore ICT-enabled knowledge curation practices in a rural setting, an in-depth case study was appropriate (Eisenhardt, 1989; Yin, 2017). The hierarchical social structure and cultural system of rural India provided an interesting research context (Qureshi et al., 2018b; Vikas et al., 2015) to study the challenges and benefits of knowledge curation. At the same time, India is a large country with great diversity among its regions in terms of language, dialects and religion, making it a rich context for research. We selected FarmScreen for our analysis as it was a large social intermediary[9] aiming to develop ICT-enabled knowledge management solutions for smallholder farmers. We observed and investigated how FarmScreen implemented agriculture knowledge curation in rural central India. Intermediaries have been using videos as an effective tool to record, store and disseminate agriculture practices because it is inexpensive compared to field demonstration (Gandhi et al., 2007; Richardson-Ngwenya et al., 2019). Dissemination happens through video screening of these agriculture practices, which are aimed at helping farmers increase productivity without additional cost.

These videos recorded the local agricultural practices that were potentially valuable: mostly low-cost but not widely known. These practices were related to dominant crops in the region, such as wheat, soybean, maize and gram. However, there were practices not related to any specific crop, such as seed germination testing using gunny bags and preparation of biopesticides and biofertilisers. The recordings provided rich detail, and the local production of the videos allowed for significant customisation of the content and presentation.

From the beginning of the project, two co-authors had extensive interactions with FarmScreen executives, regional managers and field staff and were granted access

[8] This research project was part of a broader research program for which data collection started in 2008 and is ongoing.

[9] A social intermediary is not-for-profit or for-profit organisation that prioritises social impact (Bhatt, 2017; Kistruck et al., 2013; Parthiban et al., 2021; Pillai et al., 2020, 2021; Qureshi et al., 2021a). FarmScreen was structured as a not-for-profit organisation that was involved in creating social impact through helping marginalised communities obtain necessary information, leverage local resources and develop capabilities

to the project documentation, archival data and project meetings.[10] Another co-author was invited in the middle of the project to look at the archival data with a fresh pair of eyes. The rest of the authors were invited at different stages of the project. The selection of FarmScreen was theoretically sampled as an illustration of how a practice-based view of knowledge curation can be realised through 'rural-friendly' ICT implementation.

3.1. Data collection

We visited 94 villages over four periods (P1: 2009–2010, P2: 2011–2012, P3: 2013–2015 and P4: 2015–2017; see Appendix A for more detail). We drew on four groups of data sources: unstructured interviews, semi-structured interviews, project documents and field observations. Unstructured interviews comprised 191 informal one-to-one conversations with villagers and farmers, mostly conducted in P1 to understand social norms. In addition, 151 interviews[11] were conducted in group settings across the four periods to understand the social dynamics in group settings. In total, we conducted 747 individual interviews with 461 unique individuals: we interviewed some participants multiple times over the four periods to capture their evolving perceptions and ensure consistency. On average, individual interviews lasted 55 minutes and ranged from 40 to 75 minutes. These interviews were transcribed. Table 2 provides an overview of the sources of our data collection. We discussed contextual complexity and various purposes of implementing video capturing for knowledge curation with senior executives and staff from headquarters and regional offices. We then focused on specific practices by interviewing farmers

[10] These two authors have spent decades in local rural areas. They engaged in regular reflexive internal dialogue and journaling about their respective thoughts, feelings and views to limit personal biases and more authentically capture participants' stories. This process helped us go back and forth between observations, informants' stories, social situations and our own personal experiences, thereby helping us appreciate better and remain more open to what was being revealed in the data. The author team sought to recognise and bracket our own perspectives to better capture our informants' understandings and perspectives.

[11] For interviews in a group setting with the community members, we mostly relied on the unstructured interview for the first two stages of data collection. In the next two stages of data collection, we had a broad protocol, but even at these stages the interviews more closely resembled unstructured than semi-structured interviews, as group dynamics were very different from one group setting to the next. The main objective of interviews in group settings was to understand and capture the group dynamics, such as who sits where, who gets to speak and whose voices are not heard. A group setting is an ideal occasion to observe caste and gender-related issues. The group size varied from four to 25. This was one of the reasons for variation in the interview length from 60 to 200 minutes. Other reasons were group composition, with diverse groups resulted in longer interviews; location of the interview, with public location resulting in longer interviews; and timing of the day, with interviews in the afternoon with women and evening with men being longer. On average, group interviews lasted for 120 minutes.

and video production teams from four not-for-profits (NFP). We conducted additional interviews in a group setting to ensure the data was coherent across different clusters of participants.

We had access to a rich collection of documentary materials. These documents are mainly project memos, annual reports and media releases from the FarmScreen headquarters and the NFPs offices. Many knowledge curation practices were described in these documentary materials. Document collection overlapped in time with interviews and field observation to ensure triangulation. Further, two authors conducted field observations over 448 days. They observed 26 project meetings, 39 video shootings and 52 video screening events (see additional details in Table 2). Such engagement was critical: direct observations and data collection during informal conversations provided insights that could not be captured in organisational documents or formal interviews.

Table 2. Overview of data sources

Data source	Description
Unstructured interviews	191 informal individual conversations with less-productive farmers (farmers with lower-than-average yields) 151 with villagers in group settings (average group size 13; range between four and 25)
Semi-structured interviews	75 semi-structured interviews with senior executives from FarmScreen and four NFPs 104 with staff from the headquarters of FarmScreen and four NFPs 71 with regional executives of FarmScreen and four NFPs 95 with regional staff 102 with program managers 129 with field staff 116 with video production teams 55 with productive farmers (farmers with higher-than-average yields), who appear in the video
Documents	Seven annual reports, six project reports and 18 media reports from FarmScreen, with a total of 327 printed pages 37 annual reports, 29 project reports and 51 media reports from NFPs, with a total of 1,844 printed pages
Field observation	448 days of observations in the communities (spread across eight years): 12 field diaries of 200 pages each (2,382 pages of handwritten notes) 39 video shooting events observed: 143 hours of observation (756 pages of handwritten notes) 52 video screening events observed: 103 hours of observation (479 pages of handwritten notes) 26 project and field meetings: 59 hours of observation (261 pages of handwritten notes)

NFP = not-for-profit.

3.2. Data analysis

Our data analysis was explorative and followed an interpretive research approach. The data analysis was iterative, with data collection kept flexible for emergent themes and new insights (Eisenhardt, 1989). Two authors jointly conducted data analysis. We followed a three-stage approach for our data analysis.

First, the two authors started by identifying knowledge curation activities from the collected data. Being aware of the multiple data sources, we were conscious to use a bottom-up strategy: we looked at interviews with field workers from FarmScreen and NFPs and with less-productive and productive farmers. We iteratively compared our interview transcripts with field notes and archival documents. At this stage, data was manually sorted and compiled as clustered descriptive codes.

Second, the two authors subsequently sorted the 'raw' data and clustered descriptive codes using NVivo (v.8). Given the extensive amount of qualitative data, using data analysis software helped refine descriptive codes and identify emergent themes (Miles & Huberman, 1994). Adhering to the practice-based view of knowledge management, we aimed to identify triggers and related response activities of knowledge curation practices.

Finally, other authors reviewed the data analysis results, focusing on understanding emerging themes around knowledge curation practices and any other interesting phenomena related to such practices. We developed a process model from the derived data analysis that condensed the insights into the ICT-enabled knowledge curation practices in a rural agricultural setting. Table 1 presents the data structure for the knowledge commoning process. Due to space constraints, barriers to this process are described in Appendix B.

Table 3. Data structure

First-order codes	Second-order dimensions	Aggregate dimensions
Collating information on the farmers who have above average yields Understanding what they are doing differently than other farmers in the same village or nearby villages	Unravelling knowledge	Knowledge realisation
Some traditional crops are more drought resistant; therefore, that knowledge may be more relevant in the area that has low water availability Some traditional crops are more suitable to specific soil conditions; therefore, that knowledge may be more relevant in the area that has these types of soils Some traditional crops are more pest resistant; therefore, that knowledge may be more relevant in the area that has high instances of pest attacks	Contextualising knowledge	

Encouraging knowledge providers to share their knowledge to gain social prestige Encouraging knowledge providers to share their knowledge as they will also gain from others' knowledge Encouraging knowledge providers to share their knowledge as their practices might be further refined in the process of sharing	Motivating knowledge providers	Knowledge solicitation
Many farmers are encouraged by the feeling of being on television when their practices are recorded Many farmers are fond of Bollywood movies and equate recording of their practices with Bollywood movie shooting. For many farmers, the process/experience of shooting practices is very satisfying	Using media as an incentive for knowledge providers	
Capturing the verbal articulation during the demonstration of the practice by the farmer using video as a tool Development of scripts for farmers who are not articulate	Capturing verbal articulation	Knowledge encoding
Capturing the plantation technique performed by the farmer during a demonstration using video as a tool Capturing the pesticide making technique performed by the farmer during a demonstration using video as a tool	Capturing physical activities	
Capturing the practice in the proximal surrounding of where the actual practice is conducted Ensuring that background conditions like soil feature in the video	Capturing in the proximal surroundings of the practice	
The new practice being curated does not require costly seeds, pesticides or chemical fertilisers The new practice being curated does not require irrigation infrastructure The new practice being curated does not require sowing, cultivation and harvesting equipment	Minimal capital investment	Knowledge examination
The new practice being curated uses locally available seeds The new practice being curated uses locally available biomanure The new practice being curated uses locally available biopest repellents	Resources locally available	
The selected practices should be simple to understand The selected practices might be labour intensive but not complicated	Practices easy to implement	
Intermediary needs to arrange the information more sequentially Intermediary needs to combine information from several knowledge providers in sequential order	Making knowledge more structured	Knowledge organisation
Intermediaries seek information from the same knowledge providers at multiple different times and use repeated information Intermediaries compare information from several knowledge providers and use the most common information and provide additional information towards the end of the video to provide a broader context Intermediaries seek feedback from agriculture experts on technical aspects of the knowledge and organise it towards the end of the video to provide a broader context	Increasing knowledge consistency	
Intermediary with knowledge providers' inputs selects the most salient aspects to keep the length of the video short The videos are edited to focus on the most important components to keep the length of the video short	Packaging knowledge concisely	

4. Findings

Most farmers in the rural villages were illiterate. A field manager from FarmScreen mentioned that many of the farmers could not read or write. Many farmers (knowledge recipients) could not clearly articulate what they needed to enhance farming productivity, and many productive farmers (knowledge providers) were not literate enough to document their farming activities. Consequently, it was impossible to directly collect details on farming requirements and curate agriculture knowledge from the farmers. Therefore, the field workers of FarmScreen and NFPs decided to curate knowledge from local productive farmers using a video-recording system.

Acquiring knowledge from local productive farmers instead of external experts was important because local knowledge recipients tended to assess the trustworthiness and relevance of information based on the identities of the knowledge provider. Further, a video-recording system (not an advanced knowledge management system, e.g., online forums) was selected because video recording was affordable and easy to use. More importantly, video recording could effectively capture the complexity and richness of agriculture activities without extra efforts from knowledge providers. Specifically, a knowledge provider only needed to perform day-to-day farming activities while video recording was operating. In contrast, using text-based interfaces, such as wikis or forums, would not be feasible due to the high illiteracy rates in these villages.

In the subsections below, we highlight the five processes involved in curating the practices of knowledge providers in the form of videos. At the same time, we throw light on how the exposure of completed videos to recipient farmers (viewers) can also have an effect on each of the five processes. In essence, we highlight how the content generated leads to demand from farmers who wish to learn from the lead farmers and improve their productivity, which affects various content creation stages.

4.1. Knowledge realisation

Having decided to curate knowledge from local productive farmers using video recording, the field executives (FE) and staff noticed that many productive farmers did not realise whether they had high productivity or how their farming activities led to high yields. In this sense, in some cases, they had latent knowledge that they were not aware of. In these instances, much agriculture knowledge was either *unrecognised* – farmers didn't know that they were doing something unique; *bygone*

– knowledge about traditional crops which they were no longer cultivating but might be useful for other farmers; or assumed *misfit*-because productive farmers inherited farming activities from their elder generations and assumed it no longer fit for use in the changed conditions (Appendix B). (see Appendix B). As a FarmScreen manager suggested after several rounds of field investigation, '[productive] farmers are generally not aware whether they know unique [farming] activities'. Further, some productive farmers have abandoned traditional farming activities and shifted to alternative options to attain higher revenue. However, traditional farming activities could be beneficial for other farmers who still farm under old conditions:

> Most of the farmers or their previous generations are used to cultivate [ancient grains]. Due to change in consumption patterns, a lot of them shifted to maize, rice and wheat cultivation. Some of them still possess good knowledge on cultivation activities [of ancient grains]. This knowledge is relevant in the areas that have low water availability. (NFP1, FE5)

Faced with the challenge in the early stage of knowledge curation, it became clear for the field workers that *unravelling* knowledge from productive farmers before implementing ICT-enabled solutions was essential. Unravelling the knowledge required a great deal of time and effort. Specifically, the field workers needed to identify *who* the productive farmers were, define *what* they do differently and analyse *how* they do it. We observed such knowledge unravelling process in the field and listened to multiple groups of field workers who narrated their observations of knowledge unravelling:

> We usually pick the [lead] farmer who has above average yield, who uses local material. My point is that this [lead] farmer does not use chemical inputs such as fertiliser or pesticide. Not much, even if he uses these inputs. This way, he has a lower cost compared to other farmers. This is just an example [of where farmers can reduce costs]. (NFP1, FE5)

> To uncover such [productive farming] activities, we collect information on productivity across several years. We ask farmer who has high productivity over several years about any specific practice he is following. These approaches then evoke discussion about practices. (NFP2, FE13)

The illustration above reveals an important knowledge curation practice of *realisation* through which field workers elicit agriculture knowledge from productive farmers. Knowledge realisation contributes to identifying valuable farming activities that border on extinction and collating these activities into a ready-to-be-shared state.

While realisation is a dedicated practice happening during scouting for unique productive practices that could be curated, at times, it also occurs when recipient farmers view previously recorded videos of knowledge providers. Specifically, FarmScreen conducts community screenings of the recorded videos using simple projectors that project the video to a screen or the wall. Interested farmers join the screening sessions to learn about the unique practices of other farmers that may help improve their productivity. When such screenings occur, at times, they trigger the latent knowledge of recipient farmers:[12]

> I observed several [28] screenings in the last 12 months. … Participants asked questions. They discussed [what was shown in videos] with each other. … Many of them connected what they already knew to what they observed in the video. … Initially, I thought they were bringing insights from their current farming practices. However, over time I realised that while it was mainly about the current practices, on several occasions, they were bringing insights from practices used by their ancestors. [Author's field notes]

> I saw a video [on pest control using biopesticides]. … It reminded me of my grandmother. She often used *Neem* [Azadirachta Indica] leaves. She used to soak these leaves in water for about six [or] seven days, then sprinkle that water on the crops [for pest control]. (A female farmer)

Such realisation can occur for an individual farmer or a group of farmers while they reflect on what was shown in the video. Emphasis was placed on ensuring that marginalised groups like women also had the opportunity to view the videos and voice their opinions. Wherever there was resistance to their inclusion, separate screenings were organised for them.

We label this realisation process after exposure to video *stimulated recognition*. It refers to the process of latent knowledge available with the recipient farmers being rendered conscious based on exposure to the video of the lead farmer. Significantly, such realisation of their unique practices may be closely related to the content of the video shown to them or even be unrelated to it. Such realisation on the part of the farmers surfaced in the verbal articulation when the FarmScreen field personnel encouraged the recipient farmers to reflect on what they just saw. If a farmer or a group of farmers alluded to such realisation, then FarmScreen could approach those farmers to share their knowledge.

[12] 'Recipient farmers' refers to the farmers who wish to view and learn from the unique practices of the lead farmers in the video and attempt to integrate them into their farming practices.

4.2. Knowledge solicitation

Once productive farmers were identified and related farming activities were unravelled, field workers naturally intended to invite the productive farmers to the video recording of farming activities. Surprisingly, most productive farmers refused the invitation. A few male farmers from the so-called 'upper castes' accepted the invitation. In contrast, vulnerable farmers (female farmers and farmers from 'lower castes'), who contributed more than 70% of farming work in the villages, hesitated to communicate their farming experiences due to strong social and cultural constraints. Specifically, farmers from lower castes were marginalised in local communities:

> Caste-based violence is common in [these villages]. The upper caste routinely targets lower caste farmers and farm workers. A simple thing as fetching water from the pond in the presence of them [upper caste] can lead to punishment. We do not want to get in trouble by reckless show of our knowledge. (A productive farmer from a lower caste)

In addition, many female farmers were not allowed to communicate with outsiders (i.e., people who were not from their family, especially males):

> I know some women who have developed their way of farming. Most of these [ways of farming] do not need major change. … They work in the field all the time. But in our village, women cannot [be seen] talking to men. How can they talk to [field workers]? (A productive female farmer)

The *inequality* in social classes and gender drove field workers to develop more inclusive knowledge curation solutions to *mobilise* every productive farmer, regardless of caste or gender. The key task here was to ensure that female farmers and farmers from lower castes would have an opportunity to share their knowledge. Indeed, engaging vulnerable farmers was particularly critical because vulnerable farmers provided most of the labour for farming.

To mobilise productive farmers, field workers explained the benefits of sharing knowledge with the local farming community. An important benefit, especially for vulnerable farmers, was the possibility of raising social prestige. Leading as an example provided vulnerable farmers with the opportunity to be recognised by their peers:

> Farmers would like to be known to their peers as lead farmers. This recognition comes typically from achieving high productivity without incurring the high cost of production. Once we make them aware that they have consistently higher productivity than other farmers in the nearby villages, many of them are willing to share their practices to be recognised as lead farmers. (NFP2, SE11)

Further, engaging in knowledge sharing also offered the vulnerable farmers a channel to learn from other farmers and the field workers, which was a rare opportunity for most of the vulnerable farmers as they did not often travel outside their farms or communicate with others:

> We also mention that this [knowledge sharing] is not just one-sided. Other farmers may have something interesting for these farmers. (NFP4, RE43)

In addition, most productive farmers were willing to participate after recognising that their farming activities would be recorded by videos. Their perception was that being in a video would give them popularity. They equated performing farming activities in a video with being a part of a TV program or a Bollywood movie:

> I was happy to [record] what I know. This will be seen by other farmers. Many of them. Not this village, not [next village], several villages. They will know about me. They will know about [my crop]. We do not get this opportunity to be on the TV [video]. I was happy to do it, and I will do it again if they ask. (Lead farmer 5)

> This is like a movie shooting. You have a camera. Someone is giving you direction. I am fond of watching movies. So, when they asked me to record [seed germination testing], I said yes, immediately. (Lead farmer 2)

Importantly, the motivation to share knowledge arose when previously recorded videos were displayed to recipient farmers during the community screenings. This is because the recipient farmers could see the lead farmer in the video and derive vicarious inspiration to share their knowledge just like the lead farmer in the video had done. They believed this could increase their popularity in the villages where their videos would be shared. We term this demand-driven inspiration *derivative motivation*. It refers to the process of *generated inspiration* to share knowledge after viewing the perceived popularity of the person in the video.

The above illustration forms a *solicitation* stage of knowledge curation, which mobilises many productive farmers to share their farming activities. However, the field workers acknowledged that social and cultural inequality could not be easily diminished. For example, some upper caste members actively prevented lower caste farmers from interacting with the video production teams. In this instance, some lower caste farmers opted out because they feared retaliation. Similarly, female farmers were extensively constrained by their male family members.

4.3. Knowledge encoding

Once the knowledge was unravelled from the productive farmers and the productive farmers were mobilised, field workers would make an appointment for

video shooting. However, a new challenge emerged: agriculture knowledge was complex because it was rooted at the intersection of the farm, the farmer's body and the farmer's associated farming activities. Although video recording was easy to use, capturing agriculture knowledge remained challenging due to associated *complexity*. A field worker confided, 'You cannot capture the smell of soil or how it feels [in video recording]'. Another field worker added, 'We provide some quick training for the [productive] farmers. It [recording farming activities] is not easy. Not even for our staff. We are not looking for any perfection. Our goal is that the message should be communicated clearly'.

To overcome the challenge, the field workers formed a team for each video shooting task. The team typically included three members: one manager from FarmScreen, one cameraman from local NFP and one support staff member from local NFP. The *synchronous* nature of video shooting allowed the team to mitigate the complexity of agriculture knowledge by simultaneously capturing three important aspects: productive farmers' verbal articulation, farming actions and surroundings. The manager monitored the entire video shooting process and offered guidance on vocalisation, videography and angular adjustment:

> We want to capture the practice well. We also want to capture the surrounding condition. … We instruct that video should contain details of the soil, surrounding plants, water conditions and other details. Proper video handling is needed to capture these things correctly. (FS, SE3)

Another key advantage of video recording was in helping address language and literacy barriers. For example, although productive farmers might not be able to clearly describe some aspects of the farming activities, recipient farmers could still learn from the video because they could see what the productive farmer was doing in the footage.

As the above illustrative evidence shows, we observed a knowledge *encoding* practice through which the field workers mitigated the complexity of agriculture knowledge by synchronising key aspects of farming activities. In some cases, the productive farmer asked for video shooting to be terminated. This occurred for various reasons, such as the recording being interrupted by a senior or male family member or the farmer being too nervous to perform in front of a camera. Sometimes the farmer simply changed their mind about participating. Thus, field workers often took several rounds of video shooting to ensure comprehensiveness. Sometimes,

field workers had to go back to knowledge realisation and solicitation to check if other productive farmers conducted similar activities under similar conditions. As such, the field workers could determine common strands from multiple sources and be more confident about the quality of their videos, which leads to the next key knowledge curation practice.

It is crucial to note that the richness of information recorded during the encoding process evolved. Initially, FarmScreen recorded only the verbal articulation of the practices related to the lead farmers (although in video form). However, when such information was displayed during the community screenings to the recipient farmers, FarmScreen realised that action-oriented knowledge could not be understood simply through verbal articulation in the videos. Hence, based on the feedback of recipient farmers, FarmScreen's videos gradually evolved to include the farming actions and surroundings.

> In the beginning, [in the video,] we used to capture the farmer. Let him describe the practice. The camera used to be zoomed at his face all the time. … When we [screened such videos to] farmers, they used to ask several questions about how that practice is implemented in the field. … We started integrating more on how actually practice is being done in the field. We also started filming surrounding, soil and other helpful background [ambient] information. (FS, RE8)

We term this demand-based improvement in content *recursive enriching*. It refers to the process of the betterment of the richness and contextual presentation of future content based on audiences' comprehensibility of the current content

4.4. Knowledge examination

After video shooting with productive farmers, one of the most salient challenges confronting the field workers was *inferior* video content. First, language barriers were critical. In India, the vast rural landscape and diverse cultural roots led to significant differences in dialects. Consequently, the field workers could not understand what the productive farmer communicated in the video in many cases. Video quality control would become difficult if the field workers could not clearly understand the video content. As a FarmScreen manager explained, 'we realised that filming was important. But most important was to speak the dialect of the farmer being filmed'.

Second, sometimes, the 'raw' video was not generalisable to the broader community. The variability in farming habits meant that the field workers needed to evaluate whether the recorded video content was feasible for other farmers. In some videos, for example, although the productive farmer was good at using an ancestral

repellent to yield higher productivity, other farmers could not benefit from learning effective pest control in this case because they did not know how to bend and use the repellent.

Accordingly, to *verify* video quality, the field workers 'hire[d] local field staff … [who] know the local issues … are familiar with [local] culture … [and] speak local dialects'. Managers from FarmScreen then trained the local staff to review the video to ensure the video conveyed the right message. Further, the field workers cross-checked information gathered from multiple productive farmers to ensure relevance and feasibility. This enabled the field workers to develop a common strand from different sources and to come up with a consistent description of the targeted farming activity:

> We always look for more than one farmer for any practice. … We compare information provided by each of them. … We create a video based on the common information provided by each of them. We include additional information towards the end of the video. (FS, RE13)

> Sometimes we find two or three farmers innovatively implementing the same practice. We need to capture their practice. However, each one of them might remember and tell the aspects that are most important to them.... We need to find a way to integrate their information and present it in the sequential order of implementation. (FS, RE13)

Verifying video content to address inferior video quality occurs at the *examination* stage of agriculture knowledge curation. Video shooting had been a basic but effective ICT-enabled solution to mitigate the complexity of agriculture knowledge. However, in doing so, the field workers could hardly apply sufficient quality control because the content heavily relied on how the productive farmers performed in front of the camera. Thus, video quality verification was essential.

The interventions to enhance the quality of the video improved over time. Recipient farmers' feedback during community screenings played a key role in structuring how quality control was handled. Elements like cross-checking the veracity of content with other lead farmers and accounting for differences in dialects directly emanated from observations of the (lack of) effectiveness of screening sessions:

> Without screening, it is difficult to know what will gain [recipient] farmers' attention. We also grappled with the accuracy of the information being shared. We often check this information [before screening is conducted] with other local farmers. … Many times [recipient] farmers bring this up during screening. We

> take their views into account and refine our process of checking information. (FS, RE5, responsible for video production)

We term this *reactive scanning*. It refers to improvising the quality and appropriateness of future videos based on the feedback from the recipient farmers on the current video.

4.5. Knowledge organisation

In our case, the four groups of knowledge curation practices (realisation, solicitation, encoding and examination) are not simply sequential. In fact, the field workers followed an agile approach with an intersection that *organises* the flow between the four groups of knowledge curation practices. Specifically, three manifestations constitute the intersection. First, the farming activities under consideration must be *cost-efficient*. Effective farming requested a capital investment of seeds, pesticides, fertilisers, and equipment. However, in our case, most farmers lived at the base of the pyramid (earning less than US$2.5 a day). They could not afford the extra investment in new farming resources:

> Farmers in rural India are poor, most of them. They are not willing spend money on buying costly seeds. They do not want to spend more on other agriculture inputs if new practice requires it. Any practice that requires spending more money is not going to succeed. They generally do not have money. They do not have willingness to spend their meagre money on a new practice. (FS, RE8)

> Most of the farmers we work with are small landholders. They only have half an acre of land. I mean most of them, and sometimes even less. They are barely able to survive with this. If we tell them any new practice that needs money, I mean any investment, then they will not use it. … We carefully choose practices that do not require any additional money. (FS, FE37)

Second, the resources requested by the farming activities must be *locally available*. Relevant to yet departing from cost-efficiency, some important farming resources used by productive farmers might be cheap but not available to other farmers. Farming activities that required accessible resources would be the ones other farmers would like to learn. Hence, preference was given to such practices during the examination of the videos:

> A practice that relies on locally available inputs has higher chance of succeeding. Farmers are not willing to adopt any practice that requires inputs not available in their own village or a nearby village. (FS, RE3)

Third, the farming activities being curated must be *easy to understand and replicate*. Given the low literacy rate in the rural villages, many productive farmers were not able to effectively describe and showcase their farming activities. However,

most recipient farmers were not able to read or write and relied on memory to learn from the video:

> The [productive] farmers we serve are not very articulate. They do not write anything. They simply say whatever they can recall and whatever they think is important. This information needs to be arranged in the sequence of implementation. (NFP2, RE26)

> Farmers in this region are not literate—same as in other rural parts of India. They cannot make notes. They rely on their memory. If a practice is too complicated and requires remembering too many details, then they simply give up. A practice should be easy to implement in order to be used by farmers. (FS, RE3)

These three manifestations (*cost-efficient*, *locally available* and *easy to understand and replicate*) prompted the field workers during the entire process to constantly organise and reorganise their knowledge curation practices. In this regard, the recipient farmers were important actors in helping evolve the knowledge organisation process over time. As detailed above, videos were required to be tailored to the recipient farmers based on the resources at their disposal and their ability to replicate the practices shown:

> We do check with a few farmers. We also check with agriculture experts. … But ultimately what matters is whether [recipient] farmers think it is useful. They tell us if any practice is beyond their reach [cost-wise]. … Whether the material is locally available to them to implement the practice. … They also tell us if they have understood the practice and will be able to implement it. … We take their suggestions. This helps us improve what [types of] videos will help whom [potential recipient farmers]. (FS, SE4)

> Video creation is a continuous process. It is not only important to find and film a good practice. We need to see if [recipient] farmers will have the resources to implement the practices. Whether it is too complicated for them to remember. … We try [screening] to a small group of farmers. … We incorporate their suggestions about how to sequence any practice in the video. How to arrange various information in the video. (FS, RE12)

Over time, FarmScreen learned how to make appropriate choices and structure future videos to suit the audience. The process was based on the reflections of the audience, observations made during the screenings and feedback given on the current videos. We term this process *interpretive assessment*. It refers to the process of segmentation, sequencing and targeting of future videos to the right recipient farmers based on audiences' responses regarding usability, resource viability and replicability of the current video.

5. Discussion

Knowledge is not static or given but produced and reproduced in recurrent social practices (Orlikowski, 2006). One challenge in helping farmers enhance productivity is understanding *how* agriculture knowledge is curated by overcoming strong social and cultural constraints in rural areas (Qureshi et al., 2018b; Slavova & Metiu, 2021). Following a practice-based perspective, our longitudinal case study reveals an iterative process that traverses five stages of what we refer to as knowledge commoning: (1) knowledge realisation, (2) knowledge solicitation, (3) knowledge encoding, (4) knowledge examination and (5) knowledge organisation. Figure 1 illustrates our newly developed model and the interactive knowledge commoning stages. In this section, we explain how we constructed the model and how the model can enrich the literature on ICT4D and knowledge management in rural areas.

In general, the entire knowledge commoning process is triggered by uncertainties about farmers' requirements and the feasibility of the video recording system. First, *knowledge realisation* includes practices that aim to unravel and contextualise knowledge from knowledge providers (i.e., productive farmers). In our case, the instance that triggered knowledge realisation is that many productive farmers underestimate the potential and value of their agriculture activities because these activities are inherent in their elder generations and naturally exist in their daily life. Further, many productive farmers have eliminated traditional methods of farming. Thus, the field workers need to collate agricultural activities from the productive farmers and categorise useful information based on the local conditions.

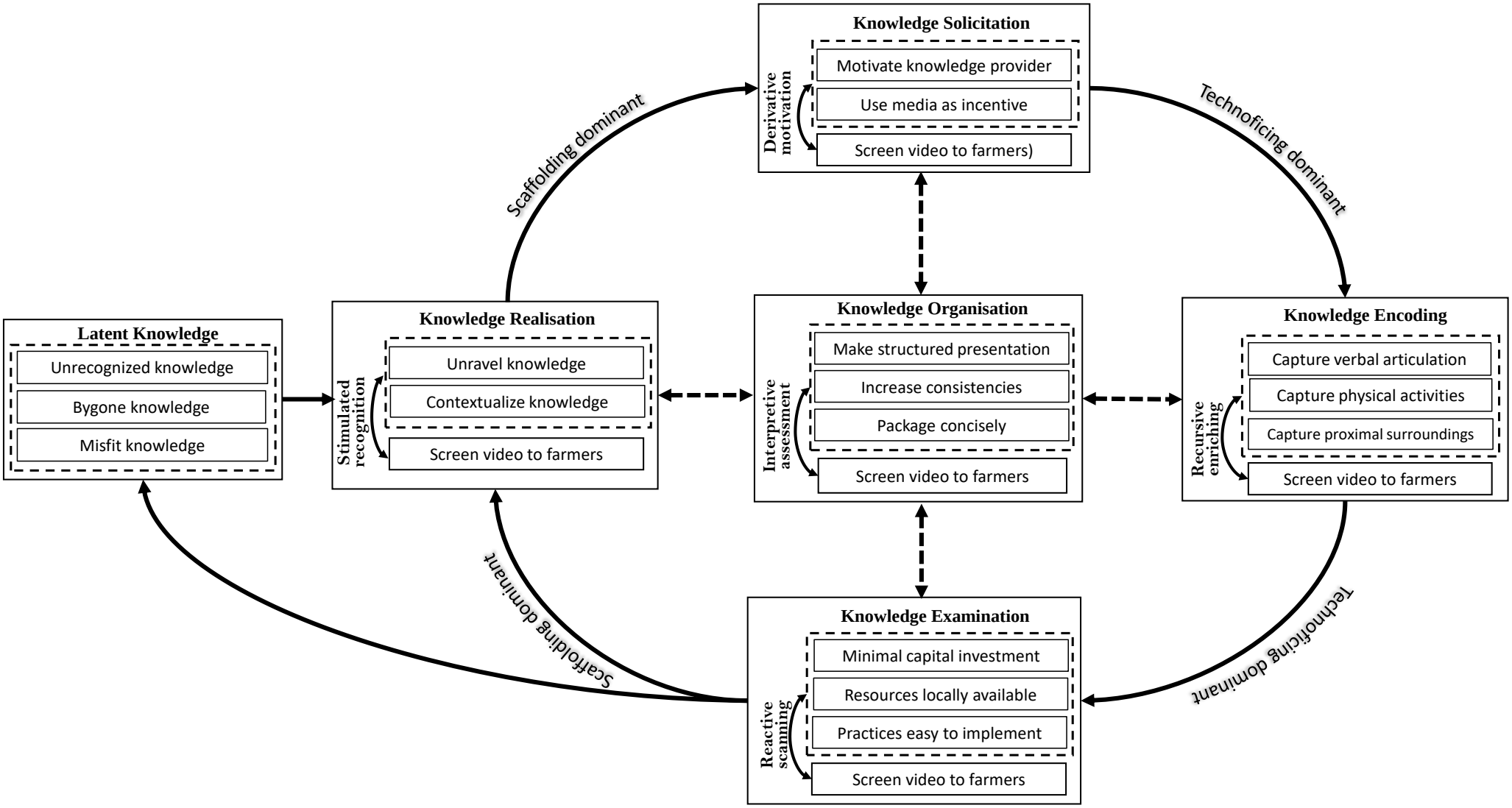

Figure 1: An Iterative Process Model of Knowledge Commoning in Rural Areas

Second, *knowledge solicitation* includes practices that aim to mobilise knowledge providers to share their agriculture activities with the broader community. Following the detection of knowledge realisation, our model reveals a challenge that many productive farmers are not willing to share their agriculture activities with other farmers due to psycho-social constraints. Specifically, female farmers and farmers from lower castes are not eager to share their knowledge because they believe that men and farmers from higher castes, respectively, will not appreciate their efforts. Further, many productive farmers cannot see the benefit from freely sharing knowledge. To tackle the challenge, the field workers use video shooting to mobilise and motivate knowledge sharing. Presenting in videos encourages voluntary farmers and other productive farmers to engage in knowledge sharing by offering an opportunity to become influential in local communities.

Third, *knowledge encoding* refers to practices that aim to encapsulate the articulation of the productive farmers, their actions and surroundings when performing agriculture activities. Agriculture knowledge is action-oriented, existing at the intersection of farmers, their farms and their activities. Further, rural areas' contextual realities for knowledge production and dissemination, such as poverty and low literacy rates, further support that video recording can be an effective tool for knowledge commoning in our case. Extracting and explicating agriculture knowledge requires an appropriate tool for its adequate representation and a systematic process to achieve the same. In this case, video shooting as an ICT solution, with the capacity to rehearse, reprocess, and accommodate different symbol sets, served as an ideal tool for capturing agriculture knowledge in a rich and comprehensive format (Dennis et al., 2008).

Fourth, *knowledge examination* refers to processes that ensure usability, consistency and quality of the final videos. The geographic spread of rural farmers entailed changes in dialects, culture, and practices, which meant raw videos could seldom be directly used by other farmers. Hence, investigating the quality of the content and then working towards improving it became important. At times, content needed to be compared from multiple farmers who talked about the same practice and combined to ensure that the video conveyed the right message. This highlighted the role of the social intermediary in constructing meaningful knowledge from the raw information recorded.

Fifth, *knowledge organisation* refers to an agile approach that investigates the cost-effectiveness and amenability of the use of locally available resources and the ease of understanding and replicability of the recorded practices. The activity spanned and was situated at the intersection of the four other knowledge commoning practices (realisation, solicitation, encoding and examination). The activity was significant as it helped enmesh the technical and social dimensions of the knowledge commoning process, thereby lending importance to both. In addition, it served as a sounding board to possible issues that may arise at later stages and, hence, aided course correction at an earlier point than would have occurred otherwise.

We synthesise the five interactive sets of knowledge practices discussed above into an overarching concept that we call knowledge commoning. Building on the extant literature (Frischmann et al., 2014; Hess & Ostrom, 2007), we define knowledge commoning as a facilitated process through which latent knowledge from high-yield farmers is embedded in its social context and is made available as commons. In this context, the knowledge commoning process is built through an evolving socio-technical ecosystem that arises at the intersection of the social actors, the information technology, the knowledge intermediary, the proximal surroundings and the local farming practices. Significantly, it is a cultivated and intermediated process, unlike the organic process of acquiring knowledge through intergenerational transfer.

Leveraging extant literature, we contextualise two key elements facilitating this knowledge commoning process: technoficing (Qureshi et al., 2021b) and scaffolding (Mair et al., 2016; Sutter et al., 2022). Overcoming resource constraints and deficiencies in the capabilities of people to use technology requires a *social-first approach* (Bhatt et al., 2022; Qureshi et al., 2021b), wherein the knowledge curation process is forefronted to address socio-economic issues faced by the farmer rather than focusing on what advanced technologies can achieve. Further, the technoficing approach leverages collaborations with grassroots organisations and uses locally available resources like field personnel for the video recording process. Such an approach is significant in the context of ICT for development, wherein the social problem at hand is more important than the level of sophistication of the technology used.

The social realities of the context meant that direct persuasion of people to transform ‘patterns of inequality’ like caste issues (Mair et al., 2016, p. 2022) would seldom be desired by the dominant caste farmers, who would prefer the status quo and its associated benefits. However, a scaffolding approach in which the goal of empowering marginalised caste members is masked through the communication of benefits of diversification of knowledge sourcing (e.g., curation of the knowledge of marginalised farmers) to the dominant communities, helps in contribution to knowledge commons from marginalised communities (the practices of a lead farmer from the marginalised community will become part of the commons) and thereby aids in indirectly improving the status of such people. As demonstrated in our model, the scaffolding approach dominates during activities like knowledge realisation and knowledge solicitation, as these are predominantly people-focused tasks, whereas technoficing dominates in activities like knowledge encoding and knowledge examination, as these are predominantly technology-driven tasks.

5.1. Theoretical contributions

At the outset, we noted the lack of research on knowledge management in a rural context from a practice-based perspective, although IS-enabled knowing in practice is growing in dominance in an organisational setting (Monteiro & Parmiggiani, 2019; Orlikowski, 2002, 2006). Our study is one of the earliest to contribute to a more comprehensive understanding of knowledge management in a rural agriculture context. By developing a conceptualisation of knowledge commoning through a dynamic process model, we make several important theoretical contributions.

First, while some studies discuss how the organic process of intergenerational transfer helps create knowledge commons in the rural context (Galang & Vaughter, 2020), our study contributes to the literature by conceptualising the cultivated process of knowledge commoning via a knowledge intermediary. Our process model of knowledge commoning acknowledges the contingent and dynamic nature of knowledge commoning in rural areas. Specifically, our model reveals that knowledge communing evolves at two levels: (1) five interactive knowledge curation stages (i.e., knowledge realisation, knowledge solicitation, knowledge encoding, knowledge examination and knowledge organisation) that occur during the sourcing process (supply side of the video) and (2) the ongoing knowledge refinement within knowledge realisation, solicitation, encoding and examination, coordinated by

knowledge organisation based on the feedback received during the dissemination of the knowledge (demand side of the video). Our process model theorises how knowledge commons can be systemically developed in a rural context, which, in turn, helps disseminate localised knowledge among rural communities. By doing so, our study complements the literature that explores effective knowledge management practices in rural areas, with localised knowledge as 'a valuable resource that can reorient modern agriculture towards more sustainable and resilient paths of development' (Šūmane et al., 2018, p. 233).

Second, this study contributes to the emerging literature on ICT4D, which outlines the role of digital technologies in enabling access to information and knowledge that can help address societal challenges, such as poverty, hunger and inequality (Aker et al., 2016; Chipidza, & Leidner, 2019). Most of the extant literature on ICT4D emphasises how digital technologies can be leveraged in disseminating expert-produced knowledge to rural farmers to enhance productivity. Our findings contribute to this stream of literature by highlighting that the established view on ICT4D, which is based on a top-down approach where technology is leveraged primarily for disseminating expert-produced knowledge, is incomplete. Our findings suggest that ICT4D can be understood more comprehensively by taking a bottom-up approach where the social context is taken into account while deploying technology to curate the local latent knowledge and convert it into knowledge commons. Thus, our findings provide a complementary perspective on the idea of ICT4D in rural areas (Aker et al., 2016; Hayes & Westrup, 2012).

Third, unlike much literature on ICT-enabled development defining requirement analysis as the first step (Giorgini et al., 2008), our study reveals an alternative initial condition for ICT-enabled knowledge management in rural areas; that is, starting from exploring the solution. In our case, although most rural farmers recognise that they must enhance agriculture productivity to overcome poverty, they cannot clearly describe exactly how they should change farming activities. Thus, our study makes a unique contribution by proposing a novel angle to help rural knowledge development and calling for more studies to explore ICT-enabled solutions and processes.

Fourth, while the literature has highlighted the importance of contextualism in rural development (Hayes & Westrup, 2012; Nijhia & Merali, 2013; Qureshi et al., 2018b), our model underscores the need to pay attention to various process involved in curating knowledge that occurs before the ICT intervention. Specifically, our study

has highlighted that much agriculture knowledge is endangered because the knowledge providers do not recognise its value and are constrained by social and cultural rules. Thus, a knowledge intermediary must give productive farmers incentives to transfer their knowledge before implementing ICT-enabled solutions.

Fifth, previous literature often considers knowledge management as a sequential or circular process (Shollo & Galliers, 2016). We explore the knowledge management practices and offer a rich description of the role of knowledge organisation as the intersection that enables an agile process. Specifically, knowledge organisation coordinates the interaction between the social dimension (i.e., hidden in voluntary social members) and the technical dimension (i.e., materialised in video footage) of rural agriculture knowledge. By doing so, we highlight the importance of understanding ICT implementation as a material vehicle of knowledge (Monteiro & Parmiggiani, 2019; Orlikowski, 2006) and shed light on an avenue towards a socio-technical solution (Sarker et al., 2019)

Sixth, our model not only describes *how* knowledge management practices occur in rural areas but also explains *why* they happen, taking local social and cultural contexts into account. With this model, we hope to empirically respond to the argument that ‘contexts are cultivated and developed in the process of ICT4D rather than ICT4D simply being embedded in context’ (Hayes & Westrup, 2012, p. 34). The key features for ICT-enabled knowledge management in rural areas are not only employing cheap and easy ICT-enabled solutions (e.g., video shooting and editing) but considering how the ICT-enabled solution can be enacted through the process of scaffolding, wherein the patterns of inequality in the community can be reshaped by concealing the objective of societal transformation through other objectives like the creation of knowledge commons as desired by the communities.

Finally, we also bring to the fore the importance of considering the capabilities of local personnel and resources available and placing the resolution of the problem at hand at the highest priority while creating knowledge commons using ICTs in community contexts. Specifically, building on the technoficing approach (Qureshi et al., 2021b), our study contributes to the literature by demonstrating how an appropriate choice of media richness (e.g., video in our case) and proportional choice of ICT tools can help effectively record and curate the multidimensional nature of the information at hand while still accounting for contextual resource deficiencies.

5.2. Practical implications

Building on the inquiries in this paper, we offer the following practice and policy contributions. First, we bring to the fore the significance of moving away from top-down, formal expert-led knowledge that is not only likely to attract distrust from the rural population but also results in knowledge inputs that are detached from the ground realities faced by rural farmers. Thereby, we highlight the significance of *listening to the voices of the knowledge-rich but poor farmers* as a potential source of knowledge that can, in turn, help address the grand challenge of agricultural productivity (Gupta, 2016). This is significant for policy in nations like India that are looking to increase farmers' income through possible modifications in services provided to farmers in both the upstream and downstream channels (Chand, 2017).

Second, we suggest that the creation of knowledge commons in the rural regions should include a set of dynamic micro-processes, including realising, solicitating, encoding, examining, and organising. The distinct aspect of creating such knowledge commons in the rural regions compared to those in urban regions (e.g., Wikipedia) arises from the need for the *cultivation of an infomediary/knowledge intermediary* with altruistic objectives to handhold the peer-to-peer sharing of knowledge across the different micro-processes. Significantly, the infomediary also requires the support of other grassroots organisations that work more closely with the rural communities. Policy think tanks could consider *creating databases for archiving such knowledge* (e.g., in line with those done for mainstream education programs like the National Program for Technology Enhanced Learning (NPTEL) in India),[13] which can then be used for targeted dissemination to relevant communities.

Third, we suggest that the issues related to a lack of resources, poor technological infrastructure and illiteracy during the process of creating knowledge commons can be addressed by the infomediary using a technoficing approach. This approach forefronts the knowledge management process and attempts to *make do with whatever resources are available* in terms of field personnel and ICT artifacts. Specifically, scarcity in such resources is overcome through leveraging locally available resources, blending resources from different regions and igniting dormant resources, among other things. From a policy perspective, governments can focus

[13] NPTEL is an Indian learning platform funded by the government wherein faculty from leading science and engineering institutes create recorded open access videos.

on *augmenting the capabilities of rural people* to use simple technologies through training and capacity building (Parthiban et al., 2020, 2021).

Fourth, we suggest that issues related to socio-cultural barriers like gender and caste discrimination during the process of creating knowledge commons can be addressed through an infomediary by leveraging a scaffolding approach. Such barriers are deep-rooted in rural communities and cannot be readily addressed through direct persuasion. *Social intermediaries mask such intended transformation* through other incentives that may encourage people to change (cf. Bhatt et al., 2022; Sutter et al., 2022). For instance, encapsulating empowerment of marginalised communities within programs that provide resource access situated in public spaces (like we saw in the case of community screenings of videos) helps overcome some of the social issues. This is also important for government campaigns that aim to empower marginalised sections of society.

6. Conclusion

In this paper, we explored alternatives to the prescriptive top-down expert-driven knowledge as a vehicle to improve agricultural productivity. In doing so, we unearthed the importance of indigenous knowledge that can be curated as a subset of a process model that we refer to as knowledge commoning. We explored the role of videos as a tool for agriculture extension activities due to their ability to adequately record the rich latent knowledge present in farming communities. We then suggested that the technological barriers in the process of knowledge commoning can be overcome through a technoficing approach, while the associated socio-cultural barriers could be navigated using scaffolding.

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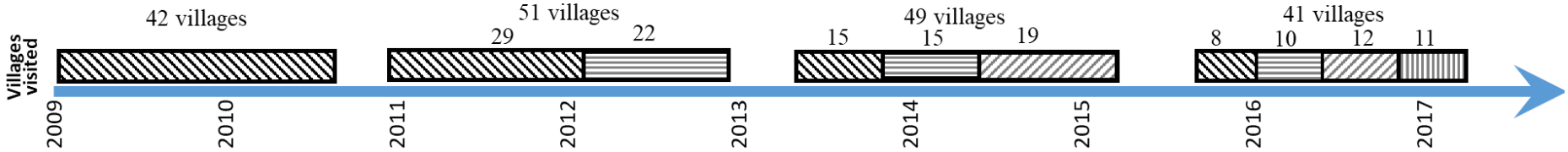
Appendix A. Data Collection Periods

Data Collection Periods

	Period 1 (P1)	*Period 2 (P2)*	*Period 3 (P3)*	*Period 4 (P4)*
Knowledge capture	Understanding approaches used by FS and NFPs towards knowledge capture, and identifying barriers to knowledge capture	Understanding motivation of knowledge providers, and facilitating conditions for knowledge capture. Identifying social barriers to knowledge capture - differences between the villages that started earlier with those started later; changes within villages between stages	Understanding challenges related to capture of unstructured information from inarticulate farmers, challenges in transforming and packaging such information - differences between the villages that started earlier with those started later; changes within villages between stages	Understanding how FS and NFPs evaluate the efficacy of videos in meeting the knowledge demands, social challenges in such evaluation - differences between the villages that started earlier with those started later; changes within villages between stages
Agriculture practices	Understanding local agriculture practices being used by farmers in the villages visited and process of selection of such practices for video	Observing social barriers to selection agriculture practices for video and their diffusion - differences between the villages that started earlier with those started later; changes within villages between periods	Observing social barriers to selection agriculture practices for video and their diffusion and measures (not) taken by FS and NFPs to overcome them - differences between the villages that started earlier with those started later; changes within villages between periods	Observing social barriers to selection agriculture practices for video and their diffusion and measures (not) taken by FS and NFPs to overcome them - differences between the villages that started earlier with those started later; changes within villages between periods
Social context	Understanding social context – caste and gender issues, social and cultural norms – and its effects on selection of farmers for video	Understanding social context (caste gender issues, sociocultural norms) and its effects on selection of farmers and shooting of video – differences between the villages that started earlier (29) with those started later (22); changes within villages between P1 & P2	Understanding social context (caste gender issues, sociocultural norms) and its effects on video production processes – differences among the villages that started in P1 (14), P2 (15) and P3 (19); changes within villages between P1, P2 & P3	Understanding of the context (caste gender issues, sociocultural norms) and its effect on video production processes – differences among the villages that started in P1 (8), P2 (10), P3 (12) and P4 (11); changes within villages between P1, P2, P3 & P4



Appendix B. Barriers to Knowledge Curation Process

First-order codes	Second-order dimensions	Aggregate dimensions
• The farmer may not know that s/he is doing something unique that may be useful to others • The farmer may have simply acquired this knowledge from his/her forefathers, and therefore may not pay attention to its uniqueness	Unrecognised knowledge	Latent knowledge
• The knowledge of traditional crops may not be used by the farmer, as s/he might have shifted to high yield alternatives • The knowledge of traditional crops may not be used by the farmer, as s/he might have shifted to different and more contemporary crops	Bygone knowledge	
• The farmer might feel that his/ her acquired knowledge is no more useful due to change in soil conditions • The farmer might feel that his/ her acquired knowledge is no more useful due to a change in water availability • The farmer might feel that his/ her acquired knowledge is no more useful due to a change in the type of pest attack	Misfit knowledge	
• Women's knowledge is not valued • Lower caste farmers' knowledge is not valued	Gender/ caste issues in unraveling knowledge	Barriers to knowledge realisation
• Knowledge is not contextualised to the farming issues faced by women • Knowledge is not contextualised to the farming issues faced by the lower caste farmers	Gender/ caste issues in contextualizing knowledge	
• Cultural taboos on sharing certain practices • Cultural belief that if a farmer boasts about productivity, then he/she will suffer productivity losses in the future	Cultural appropriateness	Barriers to knowledge solicitation
• Men do not allow women in their families to talk to an outsider • Men do not let their women be video recorded	Gender-related issues	
• Upper caste members do not let intermediaries interact with lower caste members • Lower caste members are afraid of 'showing-off' their knowledge due to repercussions it might lead to from upper caste members.	Caste-related issues	
• Knowledge provider's language (or dialect) may not be understood by the knowledge solicitors • Knowledge provider's language (or dialect) may not be understood by some local farmers	Language issues	Barriers to knowledge encoding

• Difficulty in getting talent who can conceptualise and direct the video content • Difficulty in getting talent who can shoot the video content well	Quality of field personnel	
• Within a village, there is variation in poverty levels, and therefore, the ability to invest varies • Between villages, there is variation in poverty levels, and therefore, the ability to invest varies • Across the years, due to poor monsoon or other natural conditions, the ability to invest varies.	Variation in the ability to invest	Barriers to knowledge examination
• A farmer (or village) that has more cows, has a better access to bio-manure and bio-pests repellents • A farmer (or village) that has more goats, has better access to bio-manure and bio-pests repellents • A farmer (or village) that has more neem (Azadirachta indica) plants, has better access to bio-pests repellents • A farmer, whose past generation has been engaged in farming, has better access to seeds for traditional crops	Variations in local resources	
• A farmer, whose past generation has been engaged in farming, has better farming skills • Adivasis (indigenous communities) that have recently taken up farming due to their displacement from the forest, are relatively less skilled at farming	Variations in agriculture skills	
• Some practices are difficult to organise in a single sequence • The sequence may be resources dependent • The sequence may be local soil condition dependent	Issues related to structuring	Barriers to knowledge organisation
• Knowledge providers are not articulate, and therefore, at times, it is difficult to ascertain whose account should be privileged in case of conflicting accounts over a practice. • Whose account should be privileged in case of conflicting accounts between knowledge providers and agriculture experts over the technicality of a practice.	Issues with knowledge consistency	
• Many knowledge providers are shy and do not want to engage in decision-making. This might result in the intermediary ending up deciding salient aspects to keep the length of the video short • The most important components to keep the length of the video short might reflect the knowledge providers or intermediaries' views but not necessarily the requirement of the knowledge recipients	Issues related to packaging of knowledge concisely	